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Promoting Bone Health through Weight-bearing, Resistance Training, and Balance Exercises

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Osteoporosis and Fragility Fractures

- Problem Identification

- ▶ Osteoporosis is a bone disease that results when we lose too much bone, make too little, or both. Bones lose their strength and density, and are more likely to fracture from falls or minor trauma.
- ▶ 54 million Americans have osteoporosis and low bone mass. Worldwide, 1 in 3 women and 1 in 5 men over 50 are at risk for an osteoporotic fracture.
- ▶ Female gender, advanced age, an underweight BMI, lack of estrogen as occurs after menopause or following ovarian surgery, lack of sunlight, smoking, and sedentary lifestyle all increase one's risk of developing osteoporosis or experiencing fragility fractures from minor trauma.
- ▶ Residents of northern states, like Vermont, are at an increased risk of bone loss due to limited sun exposure and decreased physical activity during winter months.
- ▶ Although healthcare providers advise about the importance of screening, calcium and vitamin D supplementation, sun exposure, smoking cessation, and physical activities like walking, there is a lack of patient knowledge on safe and specific types of weight-bearing, strength training, and balance exercises patients can participate in to strengthen their bones.

Public Health Cost

- ▶ Osteoporosis is responsible for two million broken bones and \$19 billion in related costs every year in the U.S.
- ▶ One in two women and up to one in four men will break a bone in their lifetime due to osteoporosis.
- ▶ By 2025, experts predict that osteoporosis will be responsible for approximately three million fractures and \$25.3 billion in costs annually.
- ▶ 12% of adult Vermonters have osteoporosis. In Vermont in 2007, approximately 26% of women and 3% of men over age 65 had osteoporosis. In 2009, per 1000 Vermonters over the age of 65, 3.8 men and 8.5 women were discharged from the hospital for hip fractures.
- ▶ The burden of financial cost and social impact that osteoporosis has on a national scale and in Vermont communities is continuing to rise and worsen as our population ages.

Community Perspective 1

- ▶ **Anne O'Brien** is SASH Wellness Nurse working at Elm Place, Milton's Hub for Support and Services at Home (SASH)
 - ▶ The Bone Builders Class is offered twice a week on Tuesdays and Thursdays and are free of charge. They are offered by the United Way of Northwest Vermont, not only in Milton, but all over the state.
 - ▶ The trainers teach participants weight-bearing exercises and strength training. For example, they train the upper body first without weights, then progress to using 1 to 2 lb weights.
 - ▶ The program is for participants over 55. There are 8-10 regulars and 30 people part of the SASH program, many of whom live at Elm Place, a home for seniors.
 - ▶ For those not living at the facility, transportation is a significant barrier, as many are unable to drive to the center.
 - ▶ Anne notes that "some participants have enjoyed the Bone Builders class so much that they become teachers themselves!" The goal is for exercises to not be confined to class, but be integrated into the lifestyle of the whole community.

Community Perspective 2

- ▶ **Gail Wheeler** is the instructor of the Tai Chi basic and advanced classes offered to Age Well Vermont and the Association for The Blind and Visually Impaired (ABVI), taught in Burlington.
 - ▶ When teaching for Age Well Vermont, participants are over 50, with an average age in the 70s. When teaching for ABVI, Gail notes that most participants are 78-80 years old.
 - ▶ Gail states that participants have gained a multitude of benefits over improved bone health, mobility, and balance. This includes decreased blood pressure and an overall improvement in their sense of wellbeing. One man with Parkinson's mentioned to Gail that his walking and stepping had improved as a result of the class.
 - ▶ Most classes have 10-15 people in attendance. Since it is an ongoing class, many stay over the long-term for months at a time. Some walk while others drive or are driven to the class located at a local church.

Intervention and Methodology

- ▶ Although screening, calcium and vitamin D supplementation, sun exposure, general exercise, smoking cessation, and treatment are largely discussed, I found patients to be unaware of the specific exercise routines that can be done to strengthen their bones. In response, I created a handout outlining simple and safe weight-bearing, strength training, and balance exercises patients can perform to promote good bone health and prevent osteoporosis and fragility fractures.
- ▶ I compiled these exercises outlined in the handout relying on information from the peer review journal Medicine Today's handouts on "Exercise and Osteoporotic Fracture Prevention," Marshfield Clinic's handout on weight-bearing exercises, and general information from the National Osteoporotic Foundation.
- ▶ This handout will allow physicians to better educate their patients and will serve as a starting point for patients to converse and further educate themselves on the various types of exercises they can perform to reduce their risk of osteoporotic bone fractures.

Results/Response Data

- ▶ The handout outlines four weight-bearing exercises, seven resistance training exercises, and three balance exercises. It includes general tips on how to exercise safely and what principles are used to optimize improvements in bone health.
- ▶ The handout was well received. Dr. Melisa Gibson recommended that tin cans of beans be used if patients did not have dumbbells.
- ▶ Patients said the pictures along with each description were helpful, as text without visuals would have been harder to imitate the described motions.
- ▶ One patient who was reluctant to begin exercising described the exercises as simple and easy to understand. She said that the required props, like chairs and table countertops, were easily accessible.

Promoting Bone Health – Weight Bearing, Strength Training, and Balance Exercises to Prevent Osteoporotic Fractures

Osteoporosis is a bone disease that results when we lose too much bone. It can occur in both men and women. Bones lose their density and strength, making them more likely to break from falls or minor trauma. Like sneezing or driving past a speed bump. Female's pendic, advanced age, low BMI, lack of estrogen as occurs after menopause or ovarian surgery, smoking, lack of sunlight, glucocorticoid use, and sedentary lifestyle all increase our risk of developing osteoporosis experiencing bone fractures. Physical activity helps slow the rate of bone loss as we age and protects us from injury by improving our muscle strength, balance, and bone density.

Weight-Bearing Exercise

Weight-Bearing Exercises
Weight-bearing exercises are done while standing, which forces your bones to resist the pull of gravity. These include walking, running, hiking, climbing stairs, and aerobic dance. Seated exercises like riding a bicycle and those that dampen the effects of gravity like swimming are non-weight-bearing and have negligible effect on strengthening your bones. Support yourself by holding onto a railing or countertop. Safety is a priority. Challenge yourself by holding weighted objects and increasing repetitions. Short bursts of intense exercise with break periods are more effective in improving bone health than continuously exercising at a low impact level.


- **Squatting** – Stand with feet slightly wider than shoulder-width apart. Bend 30 degrees at the hip, and stand back up again. Your knees should not extend past your toes.
- **Heel Stand** – Stand with a dandy chair behind you. Shifts (over your foot) into a seated position while bending your knees.
- **Forward Lunge** – Stand with feet shoulder-width apart. Step forward with one foot. Slowly shift your weight onto your front foot, lowering your body. Alternate with opposite foot.
- **Step Up** – Stand in front of a low step like the first stair going up. Place one foot on the step. Push on the heel of your front foot to slowly bring the back foot onto the step. Return to ground level.


Resistance Training


Resistance Training
Resistance training strengthens specific muscle groups using weights (dumbbells) or machines (leg press). Weights are lifted and lowered slowly, strengthening targeted muscle groups while also increasing bone density and improving overall wellbeing. Over time, these strength exercises should get increasingly difficult in order to improve your bone health. If you feel that using 2.5 lb weights is too easy, start using heavier weights.


Using ankle cuffs with ~1 lb removable weights

- Hip Abduct** – stand behind a sturdy chair or table, holding on. Without bending your knee or moving your waist, move one leg straight out, hold, then return to standing position.


- Hip Flexion** – stand behind a sturdy chair or table, with your side to the chair or chair's back. Bend the chest/thigh with one arm. Bring one knee in close to your chest as possible, hold, then return to the standing position.


- Hip Extension** – stand behind a sturdy chair or table, holding it. Bend your back slightly forward. Lift one leg straight up behind you as high as possible. Keep your leg straight; hold. Then slowly lower your leg back to standing position.


- Leg Lifts** – sit in a chair, slide forward, so you are near the edge of the chair and your legs are against the chair's back. Lift your feet off the ground. Straighten them out, hold, then lower your legs to the ground.



Using dumbbells weighing 2.5 lbs

- **Seated Row** – sit forward in a chair with your back straight, holding the dumbbells perpendicular to the ground. Have your elbows close to your side. Then, slowly bring your arms as far back as you can past your sides. Return arms to front of chest.

- Biceps Curl – sit** forward in a sturdy chair with your back straight or stand, brace arms to the side. Bend your elbows, bringing dumbbells up towards you. Slowly lower the dumbbells away from you. Repeat for other side.
 
- Straight Arm Row – sit** in a chair with your back straight and lean, and have your arms to the side. Raise your arms out as high as your shoulders, keeping your elbows straight. Then lower your arms to the side again.
 

Balance Exercises

Be careful to avoid falls. Use railing or have a person close by to help in case you feel wobbly.

- Tandem Walking** – will lead to toe by placing the heel of one foot in front of the toe of the other.
 
- Crossover Walking** – walk sideways, crossing one leg in front of the other. Feet should always be parallel to each other.
 
- Stand on One Leg Eyes Closed** – use support like railing or a counterstep. If you feel comfortable, slowly let go of your hand from the support.
 

Handout by Kirjal Thakur, UVA Law Center (OMB Class of 2011)

For more information on other exercises like these visit www.pearsoned.com.au/author/JohnHill/HillandHorton or www.pearsoned.com.au/author/JohnHill/HillandHorton

Evaluation of Effectiveness & Limitations

- ▶ To evaluate the effectiveness of the handout over time in changing lifestyle habits, my proposal is to measure the percent of patients who made lifestyle changes to their exercise routine as a result of the handout than otherwise would have given only verbal advice.
- ▶ A longitudinal study evaluating the effectiveness of the educational intervention in preventing the onset of osteoporosis and osteopenia in at risk older adults between the ages of 35 and 65 and also in preventing fractures in patients already with osteoporosis would contribute to knowledge on the effectiveness of this early preventative intervention.
- ▶ The effectiveness of the intervention will largely depend on the distribution of the handout and also, the conversation providers have with their patients regarding the importance of specific exercises on improving their risk of osteoporotic fracture. Physicians know their patients best, so reviewing the handout together about what unique safety precautions need to be upheld will be critical.
- ▶ The benefit to patients will rely on how well they adhere to related recommendations on increasing sunlight exposure and calcium and vitamin D intake to strengthen their bones.
- ▶ Many of the resistance training exercises outlined in the handout require dumbbells and ankle weights, items that many patients do not have and may have trouble finding. If patients live in a skilled nursing facility, they may have difficulty accessing stable supports like chairs and tables.

Recommendations for Future Interventions/Projects

- ▶ It is essential to decrease barriers that those with osteoporosis and those at risk for bone loss face to attending regular workshops like the Bone Builders and Tai Chi classes. Transportation could be addressed by encouraging carpooling or employing a van to pick up and drop off individuals to and from their homes.
- ▶ Since it may be difficult for some patients to know where to get a hold of ankle weights and dumbbells, providers can have a list of nearby stores and locations where they can find them, or suggest patients improvise, like using a can of beans as their weights.
- ▶ Although pictures speak a thousand words, creating and providing video links demonstrating each exercise would further ensure that patients know the full range of motion with the correct form. This may decrease the chances of patients performing a technique incorrectly, and prevent patients from inadvertently hurting themselves.

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